EFFECT OF WEAKLY-BOUND NEUTRONS ON PAIR-CORRELATION AND DEFORMATION

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The physics of nuclei far from the β stability line, especially close to the neutron drip line, issues an intensive challenge to the conventional theory of nuclear structure. A characteristic feature unique to the weakly-bound neutron systems is the importance of the coupling to the nearby continuum of unbound states, as well as the impressive role played by weakly-bound neutrons with low orbital angular-momenta ℓ. Weakly-bound small-ℓ neutrons have an appreciable probability to be outside of the core nucleus and are thereby insensitive to the strength of the potential provided by the well-bound nucleons in the system, while the wave-functions of weakly-bound large-ℓ neutrons stay mostly inside the nuclear potential.

Solving HFB equations in coordinate space with correct asymptotic conditions, it is shown that the occupation probability of low-ℓ orbits in the presence of pair-correlation decreases considerably already when the one-particle energy approaches continuum. When one-particle levels enter into the continuum, the low-ℓ orbit soon becomes almost unavailable for the many-body pair-correlation. One also finds that the effective pair-gap of weakly-bound low-ℓ neutrons is much reduced compared with that of neutrons with larger ℓ values. (See Fig.1 and Phys.Rev.**C68**, 034312 (2003) and to be published with B.Mottelson.)

On the other hand, weakly-bound neutrons in deformed Woods-Saxon potentials are studied by solving coupled equations in coordinate space with correct asymptotic conditions. It is found that for weakly-bound neutron levels with $\Omega^\pi = 1/2^+$ the $s_{1/2}$ component becomes overwhelmingly dominant as the binding energy of the levels approaches zero, irrespective of the size of deformation and the kind of one-particle orbits. (See Fig.2.)

The implications of these findings will be discussed.